Communal roosting habits of Indian Birds[1]

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(*With two text-figures*)

Introduction

A number of bird species of diverse orders and families and with a diversity of habits and habitats roost together for at least a part of the year. In a few cases such social roosting may be a simple consequence of the paucity of suitable roosting sites forcing the birds to crowd together. However, in a majority of cases of communal roosting the birds associate together through some social attraction and do not disperse even if alternative roosting sites are available. Some of these social groups merely comprise feeding or migratory flocks which remain together outside the roosting time as well. Leaving aside these cases, there are a number of bird species which voluntarily form new social groups specifically at the time of roosting. In this paper we will restrict our attention mainly to the latter type of communal roosting.

Although a number of accounts of Indian birds make incidental references to the roosting habits, no systematic account of this phenomenon has as yet been presented. In fact, the various published accounts of communal roosting are all based on examples selected to illustrate a particular point and we are not aware of any account which deals with the avifauna of any region as a whole (Wynne-Edwards 1962, Ward 1965, Zahavi 1971, Gadgil 1972, Ward & Zahavi 1973). The present paper aims to provide a summary of some of the commoner species included in Ali (1972) based primarily on our field experience. Numerous other examples of such communal roosters could be cited if the entire Indian avifauna as listed in Ripley (1961) were taken into account. This summary is followed by an attempt to show that such birds as roost communally in the sense defined above, contrast in certain ecological characteristics with those which do not do so. Finally, we examine the implications of these characteristics from the viewpoint of the various functions that have been attributed to the habit of communal roosting.

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Systematic Account

This account is restricted to a few of those species of Indian birds which, seasonally or at least occasionally, form communal roosts with a membership larger than a foraging or migratory flock. The name of each species, preceded by R or M (Resident or Migrant) and a sequential number, is followed by the following information:

(a) Whether the habit of communal roosting is constant throughout the year—C, or seasonal—Z.

(b) Whether, when formed, the communal roost is small in size—S, i.e. it includes five to twenty individuals; or of medium size—M, i.e. of several tens of individuals; or large—L, i.e. of several hundred individuals; or enormous—E, i.e. of several thousand individuals. Note that this refers to the number of individuals of that particular species only, and not to the overall size of the communal roost if it is a mixed one comprising several species.

(c) Whether the roost includes members of only one species, i.e. if it is pure—P; or of members of other species as well, i.e. it is a mixed roost—X.

(d) If the species associates with other species in forming a mixed communal roost, then the sequential number of the species it occurs with: thus 39 implies House Crow, 21 implies Rose-ringed Parakeet, and so on. In this list of associates at a mixed roost only the significant associates are noted. Thus the Rosy Pastor is a significant associate of the Redheaded Bunting but not *vice versa*.

Order PELECANIFORMES

Family PHALACROCORACIDAE Cormorants and Darter

R 1 Large Cormorant, *Phalacrocorax carbo* (Linnaeus)
(a) C; (b) S-M; (c) X; (d) 2, 3, 4, 7

R 2 Indian Shag, *Phalacrocorax fuscicollis* Stephens
(a) C; (b) S-M; (c) X; (d) 1, 3, 4, 7

R 3 Little Cormorant, *Phalacrocorax niger* (Vieillot)
(a) C; (b) S-M; (c) X; (d) 1, 2, 4, 7

R 4 Darter, *Anhinga rufa* (Daudin)
(a) C; (b) S; (c) X; (d) 1, 2, 3, 7

Order CICONIIFORMES

Family ARDEIDAE Herons, Egrets, etc.

R 5 Pond Heron, *Ardeola grayii* (Sykes)
(a) C; (b) S; (c) X; (d) 3, 6, 7, 39

R 6 Cattle Egret, *Bubulcus ibis* (Linnaeus)
(a) C; (b) S; (c) X; (d) 3, 7, 39

R 7 Little Egret, *Egretta garzetta* (Linnaeus)
(a) C; (b) S-M; (c) X; (d) 3, 5, 6, 39
R 8 Night Heron, *Nycticorax nycticorax* (Linnaeus)
(a) C (diurnal); (b) S-M; (c) P; (d) —

Order FALCONIFORMES
Family ACCIPITRIDAE Hawks, Vultures, etc.

R 9 Honey Buzzard, *Pernis ptilorhynchus* (Temminck)
(a) Z; (b) S; (c) P; (d) —
R 10 Pariah Kite, *Milvus migrans* (Boddaert)
(a) Z; (b) S-M; (c) P; (d) —
R 11 Blackwinged Kite, *Elanus caeruleus* (Desfontaines)
(a) Z; (b) S; (c) P; (d) —
R 12 Brahminy Kite, *Haliastur indus* (Boddaert)
(a) Z; (b) S; (c) P; (d) —
R 13 White Scavenger Vulture, *Neophron percnopterus* (Linnaeus)
(a) Z; (b) S; (c) P; (d) —
R 14 Whitebacked Vulture, *Gyps bengalensis* (Gmelin)
(a) C; (b) S; (c) P; (d) —

Order GALLIFORMES
Family PHASIANIDAE Pheasants, Partridges, etc.

R 15 Red Junglefowl, *Gallus gallus* (Linnaeus)
(a) C; (b) S; (c) P; (d) —
R 16 Grey Junglefowl, *Gallus sonneratii* Temminck
(a) C; (b) S; (c) P; (d) —

Order GRUIFORMES
Family RALLIDAE Rails, Coots, etc.

R 17 Purple Gallinule, *Porphyrio porphyrio* (Linnaeus)
(a) C; (b) S-M; (c) P or X; (d) 46, 48 and some other reed bed roosters.

Order COLUMBIFORMES
Family COLUMBIDAE Pigeons and Doves

R 18 Blue Rock Pigeon, *Columba livia* Gmelin
(a) C; (b) S-L; (c) P; (d) —
R 19 Ring Dove, *Streptopelia decaocto* (Frivaldszky)
(a) C; (b) S; (c) P; (d) —

Order PSITTACIFORMES
Family PSITTACIDAE Parrots

R 20 Large Indian Parakeet, *Psittacula eupatria* (Linnaeus)
(a) C; (b) S-L; (c) P; (d) —
R 21 Roseringed Parakeet, *Psittacula krameri* (Scopoli)
(a) C; (b) L-E; (c) X; (d) 36, 39

Order APODIFORMES
Family APODIDAE Swifts

R 22 Alpine Swift, *Apus melba* (Linnaeus)
(a) C; (b) M-L; (c) P; (d) —
R 23 House Swift, *Apus affinis* (J. E. Gray)
(a) C; (b) S-M; (c) P; (d) —

Order CORACIIFORMES
Family MEROPIDAE Bee-eaters

R 24 Chestnutheaded Bee-eater, *Merops leschenaulti* Vieillot
(a) C; (b) S; (c) P; (d) —
R 25 Bluecheeked Bee-eater, *Merops superciliosus* Linnaeus
(a) C; (b) S-M; (c) P; (d) —
R 26 Small Green Bee-eater, *Merops orientalis* Latham
(a) C; (b) S-M; (c) P; (d) —

Family BUCEROTIDAE Hornbills

R 27 Great Pied Hornbill, *Buceros bicornis* Linnaeus
(a) Z; (b) S-M; (c) P; (d) —
R 28 Grey Hornbill, *Tockus birostris* (Scopoli)
(a) Z; (b) S; (c) P; (d) —

Order PASSERIFORMES
Family HIRUNDINIDAE Swallows

M 29 Redrumped Swallow, *Hirundo daurica* Linnaeus (Migratory forms)
(a) Z; (b) L-E; (c) X; (d) 30, 46
M 30 Common Swallow, *Hirundo rustica* Linnaeus
(a) Z; (b) L-E; (c) X; (d) 29, 46, 48
R 31 Cliff Swallow, *Hirundo fluvicola* Blyth
(a) Z; (b) S-M; (c) X; (d) 29, 30, 46
R 32 Wiretailed Swallow, *Hirundo smithii* Leach
(a) Z; (b) S; (c) X; (d) 29, 30, 31, 46

Family STURNIDAE Starlings, Mynas

R 33 Brahminy Myna, *Sturnus pagodarum* (Gmelin)
(a) C; (b) S-M; (c) ± P; (d) —
M 34 Rosy Pastor, *Sturnus roseus* (Linnaeus)
(a) Z; (b) L-E; (c) X; (d) 21, 36, 37, 39, 49, 51
R 35 Pied Myna, *Sturnus contra* Linnaeus
(a) C; (b) S-M; (c) ± P; (d) —
R 36 Indian Myna, *Acridotheres tristis* (Linnaeus)
(a) C; (b) M-L; (c) X; (d) 21, 39
R 37 Jungle Myna, *Acridotheres fuscus* (Wagler)
(a) C; (b) S; (c) X; (d) 36
R 38 Bank Myna, *Acridotheres ginginianus* (Latham)
(a) C; (b) S-M; (c) ± P; (d) —

Family CORVIDAE Crows, Jays, Magpies, etc.

R 39 House Crow, *Corvus splendens* Vieillot

(a) C; (b) L; (c) X; (d) 6, 21, 36, 40

R 40 Jungle Crow, *Corvus macrorhynchos* Wagler
(a) C; (b) M; (c) X; (d) 6, 36, 39

Family PYCNONOTIDAE

R 41 Redwhiskered Bulbul, *Pycnonotus jocosus* (Linnaeus)
(a) Z; (b) S; (c) ± P; (d) —

R 42 Whitecheeked Bulbul, *Pycnonotus leucogenys* (Gray)
(a) Z; (b) S; (c) ± P; (d) —

R 43 Redvented Bulbul, *Pycnonotus cafer* (Linnaeus)
(a) Z; (b) S; (c) ± P; (d) —

Family MUSCICAPIDAE
Subfamily Timaliinae Babblers

R 44 Jungle Babbler, *Turdoides striatus* (Dumont)
(a) C; (b) S; (c) P; (d) —

R 45 Common Babbler, *Turdoides caudatus* (Dumont)
(a) C; (b) S; (c) P; (d) —

Family MOTACILLIDAE Pipits, Wagtails

M 46 Yellow Wagtail, *Motacilla flava* Linnaeus (several subspecies)
(a) Z; (b) L-E; (c) X; (d) 29, 30, 31, 32, 48, 58, 59

M 47 White Wagtail, *Motacilla alba* Linnaeus (two subspecies)
(a) Z; (b) M; (c) P or X; (d) 46

M 48 Yellowheaded Wagtail, *Motacilla citreola* Pallas (two subspecies)
(a) Z; (b) S-L; (c) P or X; (d) 30, 46

Family PLOCEIDAE Weaver Birds
Subfamily Passerinae Sparrows

R 49 House Sparrow, *Passer domesticus* (Linnaeus) and migratory subspp.
(a) C or Z; (b) M-E; (c) P or X; (d) 34, 50, 58, 59

R 50 Yellowthroated Sparrow, *Petronia xanthocollis* (Burton)
(a) C; (b) S-M; (c) P or X; (d) 49

Subfamily Ploceinae Weaver Birds

R 51 Baya Weaver Bird, *Ploceus philippinus* (Linnaeus)
(a) C; (b) L-E; (c) P or X; (d) 34

R 52 Blackthroated Weaver Bird, *Ploceus benghalensis* (Linnaeus)
(a) C; (b) L; (c) ± P; (d) —

R 53 Streak Weaver Bird, *Ploceus manyar* (Horsfield)
(a) C; (b) L; (c) ± P; (d) —

Subfamily Estrildinae Munias

R 54 Whitethroated Munia, *Lonchura malabarica* (Linnaeus)
(a) C; (b) S-M; (c) ± P; (d) —

R 55 Whitebacked Munia, *Lonchura striata* (Linnaeus)
(a) C; (b) S-M; (c) ± P; (d) —

R 56 Spotted Munia, *Lonchura punctulata* (Linnaeus)

Family Fringillidae Finches

Subfamily Carduelinae Goldfinches and allies

M 57 Rosefinch, *Carpodacus erythrinus* (Pallas)
(a) Z; (b) S-M; (c) ± P; (d) —

Family Emberizidae Buntings

M 58 Blackheaded Bunting, *Emberiza melanocephala* Scopoli
(a) Z; (b) M-L; (c) X; (d) 34, 46, 49, 59

M 59 Redheaded Bunting, *Emberiza bruniceps* Brandt
(a) Z; (b) M-L; (c) X; (d) 34, 46, 49, 58

Ecological correlates

This tentative set of bird species which roost communally clearly includes species with very diverse habits. It includes birds of marshes and jheels, open grasslands, cultivation, scrub and forests; birds which are purely graminivorous, insectivorous as well as omnivorous, predators, and scavengers. Not only do birds of such diverse habits share in common the habit of communal roosting, but birds with very similar habits may differ from each other in this regard. Thus the Roseringed and Large Indian Parakeets (*Psittacula krameri* and *P. eupatria*) roost communally whereas the Blossomheaded Parakeet (*P. cyanocephala*) presumably does not. Nevertheless a more detailed examination of the data reveals that there are certain general, though maybe only statistical trends. For this purpose we contrasted the distribution of certain characteristics of the fifty-nine species listed above, with the distribution of these characteristics amongst the non-communal roosters included in Ali (1972). The latter list was taken as a fair representation of the common bird fauna as a whole, though it may overemphasize plains (*v.* hill) birds and species found near human habitation. A number of characteristics namely habitat, nature of food, nature of foraging group scrubland and cultivation is markedly greater and the proportion of birds of more wooded habitats markedly smaller amongst the communally roosting species was found to differ suggestively from the set of non-communal roosters in particular with respect of the nature of the habitat and of the foraging group (see fig. 1).

The proportion of birds of aquatic habitat is not very different between the non-communal and the communal roosters. However, the proportion of birds of more open terrestrial habitats such as grasslands, scrubland and cultivation is markedly greater and the proportion of birds of more wooded habitats markedly smaller amongst the communally roosting birds. A further examination of the data shows that the bird species forming large or enormous communal roosts such as the Baya Weaver Bird, Rosy Pastor or Indian Myna all belong to open habitats, while the species of the communal roosters of the more thickly wooded habitats such as the Great Indian Hornbill and the Jungle-

fowl do not roost communally as a constant feature, i.e. do so only seasonally and usually form pure, not mixed roosts.

The second clearcut difference between the communal and the non-communal roosters is in the nature of feeding groups. It will be noted that the proportion of solitary feeders, and even more strikingly the proportion of bird species feeding in pairs, is markedly smaller and the proportion of flock feeders markedly greater amongst the communal roosters. Most of the species feeding in pairs are resident species and it is very likely that these birds are pair-bonded and territorial on a year-round basis. The incompatibility of territoriality with communal roosting may be the cause of the near-absence of birds feeding in pairs amongst the communally roosting birds.

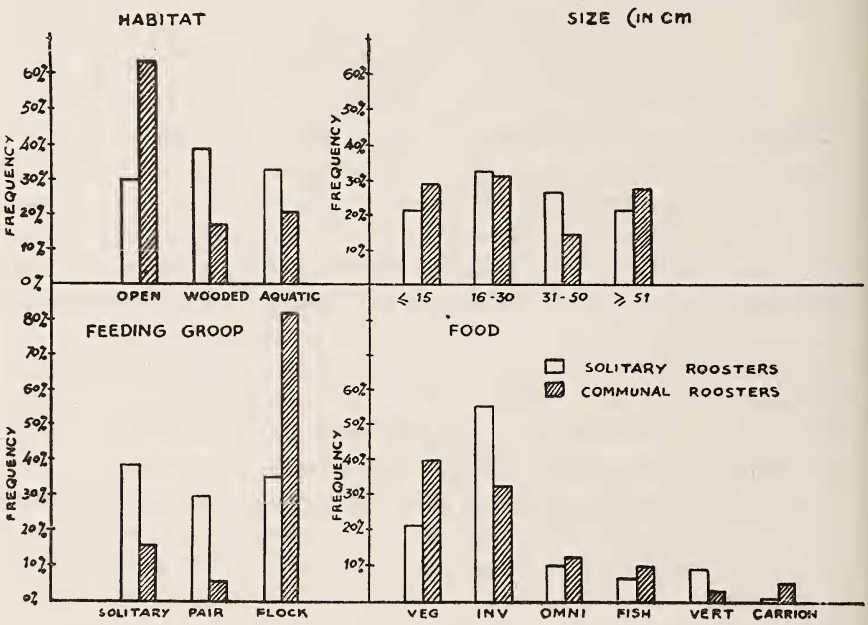

Fig. 1. Differences in the frequency of different attributes amongst the set of species which roost in a non-communal fashion, and the set of species which roost communally. The food categories represented are (i) Vegetable matter, i.e. seeds, grains, shoots, fruit and berries; (ii) Invertebrates including insects, molluscs etc. (iii) Omnivorous feeding habits. Although most bird species are omnivorous in a litteral sense, only those whose diet regularly includes substantial amounts of both plant and animal food are included. (iv) Fish. (v) Vertebrates other than fish, particularly lizards, rodents and other birds and (vi) Carrion.

Thirty-three of the fifty-nine bird species that roost communally form roosts restricted to a single species, i.e. pure roosts. It is notable that these roosts are almost always of a small size. Only in the case of Blue Rock Pigeon and the Large Indian Parakeet are large pure roosts oc-

casionally formed. It is also possible that the large roosts of Black-breasted and of Streaked Weaver Bird are also more or less pure roosts; but this needs to be confirmed by further field observations. On the contrary in the six cases where enormous roosts are formed, the roosts are invariably of a mixed nature. The various associates at a mixed roost may be of similar feeding habits as in the case of three species of wagtails roosting together, or may be of very dissimilar feeding habits as is the case with the association of the House Crow, the Cattle Egret and the Roseringed Parakeet. Fig. 2 presents an analysis of the data from this view point. It shows that a mixed roost is almost equally likely to be made up of species of dissimilar as of similar feeding habits.

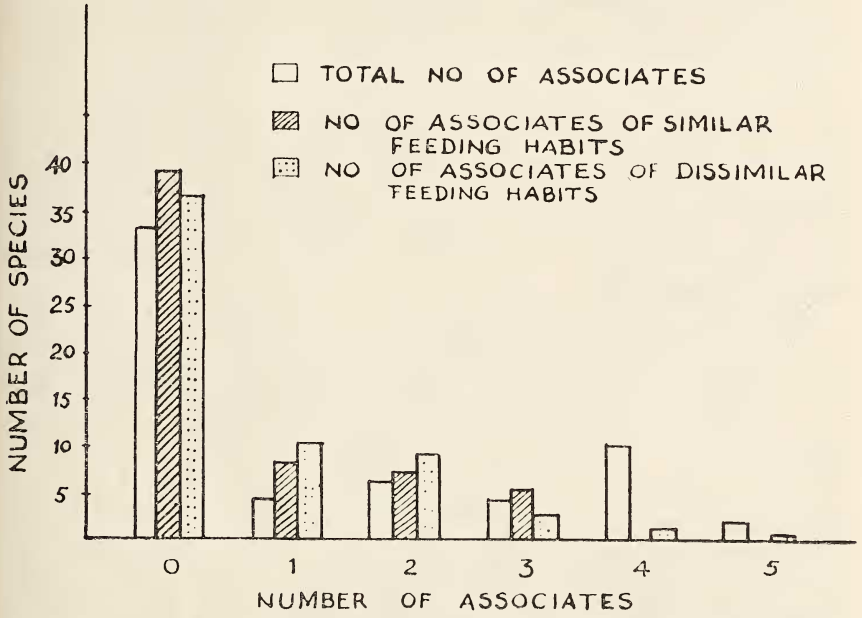

Fig. 2. Number of communal roosters with different numbers of significant associates. Thus thirty-three species form pure communal roosts; thirty-nine species have no associate of similar feeding habits; ten species have one associate of dissimilar feeding habits; ten species have a total of four other associates (whether of similar or dissimilar feeding habits) and so on.

Functional significance

Recently a number of interesting suggestions have been made as to the nature of the advantage conferred on birds participating in communal roosting. The four major hypotheses in this respect are: (a) Communal roosting enables birds to conserve heat (b) Communal roosting enables birds to assess population densities which are then adjusted to the prevailing level of food supply through emigration and adjustment

of reproductive rate (c) Communal roosting serves the function of communication of information regarding the location of food sources (d) Communal roosting enables birds to reduce the risk of predation.

Although it is likely that more than one of these functions may be simultaneously served by communal roosting, the best method of testing the various alternative hypotheses is to try to generate predictions on the supposition that any one of them is the primary function. Thus on hypothesis (a) Communal roosting will be most prevalent amongst birds most susceptible to heat loss. On this supposition communal roosting should be commoner amongst birds of higher latitudes and altitudes. This is probably not true, though our data does not lend itself to testing this. It does, however, lend itself to another test. Small birds must be more susceptible to heat loss because of their greater surface to volume ratio. We may therefore expect communal roosting to be commoner amongst the smaller birds. A comparison of the distribution of size between the communal and non-communal roosters however reveals only a slight bias towards smaller birds amongst the former. Also the ambient temperature is unlikely to produce vital changes under Indian conditions. We may therefore tentatively reject the hypothesis that heat conservation is the primary function of communal roosting amongst Indian birds.

The second hypothesis, namely that communal roosts serve the function of assessment of population density was first put forward by Wynne-Edwards (1962) and has aroused considerable controversy. The major objection to this hypothesis lies in its inconsistency with the principle of natural selection. We may however ignore this and see if we can derive any testable predictions from the hypothesis. The need for an assessment of population density to be adjusted to the food supply must be greatest where the populations achieve levels close to those supported by food supplies. Such species are the so called *K*-strategists (MacArthur 1962, Cody 1966, Gadgil & Solbrig 1972). We may therefore predict that according to the Wynne-Edwardsian hypothesis, communal roosting will be commoner amongst birds from less harsh, more equable environments. A number of comparisons such as those suggested by Cody (1966) may be made to test this. Our data lends itself to one such test. We may on the whole expect that wooded habitats provide a less harsh environment as compared to open habitats. Then, we may expect communal roosting to be commoner amongst birds of wooded as opposed to open habitats. Our data does not support this hypothesis.

The phenomenon of mixed roosting also poses difficulties for this hypothesis. If the communal roost serves the function of assessment of population density in relation to the level of food supply, then the assessment of the density of the population of another species could

serve no useful function, unless that species also has very similar feeding habits. Wynne-Edwards (1962) does in fact contend that species of dissimilar feeding habits associate in mixed roosting only in rare cases. However our data shows this claim to be false; in fact an associate species is, if anything, more likely to be of dissimilar than of similar feeding habits (fig. 2).

The third and the most novel hypothesis, namely that communal roosts serve as centres for the exchange of information regarding the location of food sources was first put forth by Ward (1965) (see also Zahavi 1971, Ward & Zahavi 1973). If a species feeds on rather patchy and temporary food sources, then the individuals of that species need to find new food sources continually. If a flock that has discovered a good patch of food recently tends to fly to the patch in the morning with a characteristic flight, then other flocks at the roost which have failed to find a good patch of food on the previous day can join in and take advantage of the patch of food found by the first flock. This is a most attractive hypothesis and on its basis we expect communal roosters to be largely flock feeders. Our data confirms this in that flock feeders are certainly much better represented amongst communal roosters as compared to the non-communal roosters. However, communal roosters include a number of solitary feeders as well, notably the Common Pariah Kite and the White Scavenger Vulture. A more careful examination of the feeding habits of these would greatly help to clarify whether these birds do communicate information about the location of food sources in spite of the apparently solitary mode of feeding. Secondly, we may expect certain kinds of food sources to be much more patchy and temporary than others, e.g. fruit as opposed to rodents. An examination of the nature of food categories of communal roosters shows that invertebrates including insects and terrestrial vertebrates such as lizards and rodents are poorly represented in the diet of communal in comparison to non-communal roosters. It is certainly plausible that these food items are likely to be more widely dispersed and less likely to be temporary as compared to others such as fruit, though we need more detailed evidence before claiming that this strengthens our belief in communication of food locations as a function of communal roosting.

Lastly, communal roosts may serve an antipredatory function. Although communal roosts are likely to be at a disadvantage by being more conspicuous and therefore vulnerable, the advantage gained in receiving warning of the approach of predators from other members can be considerable and may outweigh the former disadvantage. Zahavi (1971) mentions that it was easy for his bird ringing group to catch by hand wagtails roosting solitarily, but very difficult to catch any from a communal roost. We would therefore expect communal roosting to be characteristic of those birds which (a) do not become much

more conspicuous than solitary roosters as a result of communal roosting and (b) which have a well developed system of warning signals. Condition (a) is probably fulfilled by birds of more open habitats, and (b) by birds which feed socially as well and therefore have developed a more elaborate warning system. Our data does show preponderance of birds of open habitats and flock-feeders amongst the communal roosters.

It is possible that smaller birds are more susceptible to predation and we should have expected a higher representation of them amongst communal roosters if avoidance of predation were a major function of communal roosting. However, as mentioned above, such bias is not very pronounced.

The phenomenon of mixed roosting strongly supports the notion of avoidance of predation being an important function of communal roosting (Gadgil 1972). There can hardly be communication of food location amongst birds of as different feeding habits as the House Crow and the Roseringed Parakeet. It is much more likely that both these species roost communally for predator avoidance and pool this advantage by forming mixed roosts of greater numerical strength. However, in certain other cases such as House Sparrow and Spanish Sparrow, the Weaver Birds and the Buntings, there may be communication of food location amongst different species as well. The whole problem of relations amongst different species at a mixed communal roost has yet to receive serious attention.

In conclusion, our data suggests that communication of information about the location of food sources and avoidance of predation are probably the two most significant functions of communal roosting.

Summary

At least the listed fifty-nine species of common Indian birds definitely form communal roosts in groups larger than feeding or migratory flocks without being forced to crowd together by a paucity of roosting sites. Thirty-five of these form communal roosts constantly throughout the year, another nine are migrants that roost communally during winter in India, and the rest of the species roost in a communal fashion only in the non-breeding season. Twenty species form small roosts of several individuals, twenty medium sized roosts of tens of individuals, nine large roosts with hundreds of individuals and ten enormous roosts of thousands of individuals of the given species. Twenty-six of these form mixed communal roosts of more than one species and birds of similar and dissimilar feeding habits are almost equally represented amongst the associates at a mixed communal roost. All of the

species that form roosts of thousands of individuals have some other species roosting in company with them. Birds of open habitats and birds which feed in flocks are represented to a much greater extent amongst communal roosters in comparison with the bird fauna as a whole, while birds which feed in pairs are represented very poorly. These features suggest that communication of information about food sources and reduction of the risk of predation are the two important functions of communal roosting.

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